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WHAT IS CLAIMED IS:

- Sub A 7
1. A membrane structure comprising a silicon film having a grain structure including grains defining pores therebetween.
 2. A membrane structure comprising a silicon film including grains having gaps formed therebetween to define individual pores, the maximum cross-sectional dimension of any one grain approximately equal to the thickness of the film.
 3. The structure of claim 2 wherein a lateral dimension of any pore is less than that of any grain.
 4. The structure of claim 2 wherein a lateral dimension of the pores is between about 10 and 50 nanometers.
 5. The structure of claim 2 wherein the thickness of the film is less than or equal to about 150 nanometers.
 6. The structure of claim 2 wherein the thickness of the film is between about 50 and 150 nanometers.
 7. The structure of claim 2 wherein the roughness of the film is approximately equal to its thickness.
 8. The structure of claim 2 wherein the film forms a filter.
 9. The structure of claim 2 wherein the film is conformal to an underlying surface.

29 10. The structure of claim 2 further including a structural
30 layer to support the film.

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32 11. The structure of claim 2 further including a conformal
33 layer formed on the film to provide a selected chemical or
34 biological function.

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36 12. A membrane filter structure comprising a silicon film
37 having a grain structure including grains defining pores
38 therebetween, a lateral dimension of the pores being between
39 about 10 and 50 nanometers and the maximum diameter of any one
40 grain not exceeding the thickness of the film.

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42 13. A method of fabricating a membrane structure comprising:
43 forming a sacrificial layer over a first surface of a
44 substrate;
45 forming a silicon layer over the sacrificial layer such
46 that the silicon layer has a grain structure including
47 grains defining pores therebetween wherein the maximum
48 diameter of any one grain does not exceed the thickness
49 of the membrane structure; and
50 removing the sacrificial layer.

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52 14. The method of claim 13 further including forming a
53 passageway through the substrate.

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55 15. The method of claim 13 further including forming a
56 conformal layer over the silicon layer to provide a selected
57 chemical or biological function.

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59 16. A method of fabricating a membrane structure comprising:

60 forming a sacrificial layer over a surface of a
61 substrate;
62 forming a structural layer over the sacrificial layer;
63 forming a silicon layer over the structural layer such
64 that the silicon layer has a grain structure including
65 grains defining pores therebetween wherein the maximum
66 diameter of any one grain does not exceed the thickness
67 of the membrane structure; and
68 removing the sacrificial layer.

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70 17. A method of fabricating a membrane filter structure
71 comprising:

72 forming a sacrificial layer over a first surface of a
73 substrate;
74 growing a silicon film over the sacrificial layer at a
75 temperature near the tensile-to-compressive transition
76 temperature of the silicon film such that the silicon
77 film has a grain structure including grains defining
78 pores therebetween wherein the maximum diameter of any
79 one grain does not exceed the thickness of the membrane
80 filter structure; and
81 removing the sacrificial layer

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83 18. The method of claim 17 wherein the silicon film is
84 formed under a near zero-stress condition.

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86 19. The method of claim 17 wherein the silicon film has a
87 residual stress within a range of about -50 to 50 mega-
88 Pascals.

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90 20. The method of claim 17 wherein the silicon film has a
91 residual stress within a range of about -100 to 100 mega-
92 Pascals.

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94 21. The method of claim 17 wherein the silicon film is grown
95 such that a lateral dimension of any pore is less than that of
96 any grain.

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98 22. The method of claim 17 wherein the silicon film is grown
99 such that a lateral dimension of the pores is between about 10
100 and 50 nanometers.

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102 23. The method of claim 17 wherein the silicon film is grown
103 such that the thickness of the film is between about 50 and
104 150 nanometers.

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106 24. The method of claim 17 wherein the silicon film is grown
107 such that the roughness of the film is approximately equal to
108 its thickness.

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110 25. The method of claim 17 further including forming a
111 conformal layer on the silicon film to provide a selected
112 chemical or biological function.

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114 26. The method of claim 17 further including monitoring the
115 residual stress of the silicon film.

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